IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of
Martin KASPAR et al.
Corres. to PCT/EP03/02995
For: COOLANT CONDENSER

TRANSLATOR'S DECLARATION

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Sir:

I, the below-named translator, certify that I am familiar with both the German and the English language, that I have prepared the attached English translation of International Application No. PCT/EP03/02995, and that the English translation is a true, faithful and exact translation of the corresponding German language paper.

I further declare that all statements made in this declaration of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of legal decisions of any nature based on them.

September 7, 2004
Date

Name: Nigel David CROSSAN
For and on behalf of RWS Group Ltd

Coolant condenser

The invention relates to a coolant condenser having a network composed of tubes and ribs, collecting tubes arranged on both sides of the network and having a collector which is connected to one of the collecting tubes by means of at least one inflow opening and at least one outflow opening and is arranged in parallel with it, in particular according to the preamble of patent claim 1 or claim 10.

The invention also relates to an insert part for a collector of a condenser of an air-conditioning system for motor vehicles, in particular according to the preamble of patent claim 13.

The condenser which is known from DE-A 197 12 714 by the applicant is what is referred to as a condenser module which is characterized by a collector which is integrated with the condenser. In this context, this collector is of tubular design, is arranged in parallel with one of the two collecting tubes of the condenser and is connected fluidically to the adjacent collecting tube via an inflow opening and an outflow opening. A dryer/filter cartridge is positioned in the collector and is connected in a positively locking and detachable fashion to a closure stopper by means of a latch connection. After the condenser has been soldered, the dryer/filter cartridge is inserted into the collector, which is then sealed in a fluidic and pressure-tight fashion by the closure stopper. The dryer/filter cartridge has a plastic housing with a circumferential sealing lip which is arranged between the inflow opening and the outflow opening and divides the collector into an inflow space and an outflow space. After the coolant flows through the dryer/filter cartridge, it thus passes out of the inflow space into the outflow space and thus back into the network of the

condenser. A detailed description of such a condenser module can be found in DE-A 44 02 927 by the applicant. The flow through the dryer/filter cartridge which is filled with granulate causes a considerable drop in pressure for the coolant, which, after it emerges from the condenser, flows through the entire collector until it re-enters the supercooling section of the condenser.

Further designs of dryer/filter cartridges have been disclosed by DE 200 04 438 U1, FR-A 2 750 761 and EP-A 0 921 022. In DE '438 spacer elements are necessary to position the dryer/filter cartridge in the collector. In the dryer/filter cartridge according to EP '022 and FR '761 a dividing wall is necessary in the collector and the lower end of the dryer/filter cartridge is inserted into said dividing wall while the upper end is connected to the closure stopper. A disadvantage with these designs is that the cartridge is relatively long and not easy to handle in terms of installation and removal.

An object of the present invention is to improve a coolant condenser or an insert part of the type mentioned at the beginning in such a way that the number of individual parts for a dryer/filter unit and possibly their costs are reduced, and the installation and removal of the unit are also possibly facilitated.

The means of achieving this object are apparent from the features of the independent claim 1.

The spatial separation of the drying and filtering of the coolant gives rise to a smaller drop in pressure for the coolant which flows through the collector. This reduced pressure loss has a positive effect on the performance of the entire condenser. Furthermore, the drying/filtering function unit is simplified in terms of its design because additional individual parts such as spacer elements are dispensed with. Arranging the

closure stopper and the insert which is connected to it in the lower region of the collector, that is to say in the region of the inflow and outflow openings, makes the entire insert shorter.

According to one advantageous refinement of the invention, the insert is of pot-shaped design and embodied as a separate filter unit which is either designed to be clipped to the closure stopper as a mounted unit or is embodied in one piece with it as an injection molded part. The filtering effect is functionally improved insofar as the coolant flows firstly into the interior of the pot-shaped insert, from there radially outwards via filter sieves into an annular space and from there back into the condenser. The arrangement of the filter sieves on the circumference produces a larger filter passage area and thus a smaller drop in pressure for the coolant. Particles of dirt which are held back by the sieve can collect on the bottom of the pot-shaped insert and thus do not block the filter. The manufacturing costs can be reduced by manufacturing the insert and closure stopper as a single-piece injection molded part, whether from plastic or from an aluminum alloy. As a result of the closure stopper being secured in the collector, the insert is simultaneously positioned in the collector, which is significant in particular for the sealing lip since it has to be arranged between the inflow opening and the outflow opening.

According to one advantageous development of the invention, the drying is carried out by means of a small bag of desiccant which is positioned above the filter insert, which is permeable to the coolant and holds a desiccant in granulate form in its interior. This little bag is supported on the edge of the pot-shaped insert so that the cavity in the interior of the filter insert remains free.

Advantageous developments emerge from the features of claims 2 to 9.

A further solution is obtained according to the features of claim 10. Here, the filter insert as a single-piece plastic injected molded part is lengthened to form a dryer cartridge which holds the desiccant in granulate form. It is thus possible to introduce the desiccant and filter from below into the collector as one part with the closure stopper and position it there in its operating position. The upper part of the dryer cartridge, i.e. above the sealing lip, has a relatively large circumferential area which is penetrated by windows and is covered by a relatively large-mesh filter fabric. As a result, relatively large particles of dust remain outside the cartridge. The lower part of the cartridge, i.e. below the sealing lip, also has window-like breakthroughs which are however covered by a relatively fine-mesh filter sieve. The combination of large-mesh and fine-mesh filters reduces the drop in pressure of the cartridge.

According to a further advantageous refinement of the invention, the dryer cartridge with the closure stopper which is manufactured in one piece from plastic, forming the insert part, is sealed with respect to the collector by means of O rings. As a result of the internal pressure in the collector, the closure stopper which is partially of hollow construction is widened somewhat owing to the lower modulus of elasticity of plastic so that the O rings are additionally pressed and the sealing effect is thus increased.

Advantageous developments emerge from the features of claims 11 and 12, and 14 to 23.

The invention is illustrated by way of example in the drawing with reference to exemplary embodiments and is described in more detail below.

Fig. 1 shows a filter insert, connected to a closure stopper by a clip connection,

Fig. 2 shows a filter insert, manufactured in one piece with the closure stopper, in a collecting tube, and

Fig. 3 shows a dryer/filter cartridge which is manufactured in one piece as a plastic injection molded part.

Fig. 1 has an insert 1, composed of a closure stopper 2 and a filter insert 3. This insert 1 is inserted, similarly to the prior art described at the beginning, into a collector (not illustrated here) of a coolant condenser for an air-conditioning system of a motor vehicle. The closure stopper 2 is embodied in a similar way to that described in DE-A 100 39 260 by the applicant, i.e. it has, on its circumference, two annular grooves 4 into which O rings (not illustrated) are inserted in order to seal the closure stopper with respect to the inner wall of the collector (not illustrated). The closure stopper 2 is manufactured from an aluminum alloy and is secured in the collector in both directions. The filter insert 3 is connected in a positively locking and detachable fashion to the closure stopper 2 by means of a clip connection or latching connection 5 and is thus also centered with the closure stopper 2. The filter insert 3 is of pot-shaped design, i.e. it has a bottom 6, a cylindrical wall 7 and an edge 8 which is continuous toward the outside in the radial direction with an elastic circular sealing lip 9. The wall 7 is penetrated by rectangular windows which are distributed over the circumference, of which two windows 10, 11 can be seen in the sectional view in the drawing. In each case webs 12 are left between these windows 10, 11. The window-like breakthroughs 10, 11 are covered by fine-mesh filter fabric 14, 14. As a result, the pot-shaped insert 3 has a cylindrical free interior 15 which is

manufactured as a plastic injection molded part.

Fig. 2 shows a further exemplary embodiment in which an insert 20 is composed, as a single-piece injection molded part, composed of a closure stopper part 20a and a filter part 20b. Moreover, both the closure part 20a and the filter part 20b are of similar design to the exemplary embodiment according to fig. 1, with the difference that the clip connection 5 is dispensed with for the sake of the single-piece design. The insert 20 is inserted into a partially illustrated collector 21, sealed by O rings 22 and secured axially by means of a securing ring 23 (as is also known from the abovementioned prior art). The collector 21 of tubular design has an inflow opening 24 and an outflow opening 25 via which the coolant of the condenser (not illustrated) flows into the connector 21 and flows out of it again. Arranged between these two openings 24, 25 is a sealing lip 20c which is formed on the insert 20 in its upper region 20b and which divides the interior of the collector 21 into an inflow space 26 and an outflow space 27 which is formed as an annular space in the region of the outflow opening 25. A little bag 28 of desiccant is loosely arranged above the insert 20, i.e. above the sealing lip 20c; said little bag 28 is filled with a known desiccant in granulate form and thus draws moisture out of the coolant. Window-like breakthroughs 30, covered with a filter fabric 29, are arranged at the level of the annular space 27, as in the exemplary embodiment according to fig. 1.

The function of the abovementioned dryer/filter unit is as follows: the coolant, represented by an arrow E, enters the inflow space 26 of the collector 21 where it comes into contact with the little bag 28 of desiccant or with the granulate located in the interior of the little bag 28. The coolant flows through and around the bag 28 since the latter does not fill the entire free cross section of the collector 21. The coolant from

which moisture has thus been removed then enters the interior space 31 of the insert part 20b. The coolant is present here in the liquid phase and leaves the interior space 31 radially through the filter fabric 29 toward the outside, enters the annular space 27 and flows from there via the outlet opening 25, following the arrow A, into the condenser (not illustrated here) or its collecting tube (not illustrated either). From there, the coolant reaches a supercooling section of the condenser (not illustrated).

Fig. 3 shows a dryer/filter cartridge 33 in which a closure stopper 34, a filter insert 35 and a dryer sleeve 36 are embodied in one piece as an injection molded part with a circumferential sealing lip 37. The closure stopper 34 and the filter insert 35 in conjunction with the sealing lip 37 are embodied in a similar way to those in the previous exemplary embodiments according to fig. 1 and fig. 2, i.e. inside the filter insert 35 there is an approximately cylindrical cavity 38 which is connected to the outside via filter openings 39. The dryer cartridge which is arranged above the sealing lip 37 as a prolongation of the filter insert 35 is composed of a cage-like sleeve 40 which has a plurality of breakthroughs 41 which are also covered by a filter fabric 42 (illustrated by cross hatching). The sleeve 40 in which granulate (not illustrated) for drying the coolant is located contains, in its upper region, a pressure plate 43, a compression spring 44 and a closure cap 45 which is supported on the outside by a cross-sectional constriction 46 of the sleeve 40. The entire dryer/filter cartridge 33 is positioned in the collector (not illustrated) by the closure stopper 34, i.e. additional spacer elements are not necessary. The unit 33 is pushed into the collector tube from below, i.e. in the region of the condenser where the outflow opening (cf. figure 2, reference number 25) is located. This results in a minimum overall length for the entire

dryer/filter unit 33.

The closure stopper 34 can be embodied in a similar way and be attached in the collector as described in the abovementioned DE-A 100 39 260 by the applicant. Here, owing to the construction using plastic which has a lower modulus of elasticity than, for example, aluminum, an additional advantage is obtained: as a result of the internal pressure in the collector which also acts on the interior of the closure stopper 34 which is of partially hollow construction, said closure stopper 34 widens toward the outside, i.e. in the radial direction, so that the O rings (not illustrated here) are pressed somewhat more strongly and thus bring about a better sealing effect.

Overall, there is a favorable drop in pressure for the dryer/filter cartridge 33 because a relatively large and large-mesh filter surface is available in the upper region of the cartridge, i.e. above the sealing lip 37, while a fine-mesh filter is provided in the lower region, i.e. below the sealing lip 37.